# POPULAR MECHANICS

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"Tells you how to do things" Written so you can understand it

Smithsonian Institution

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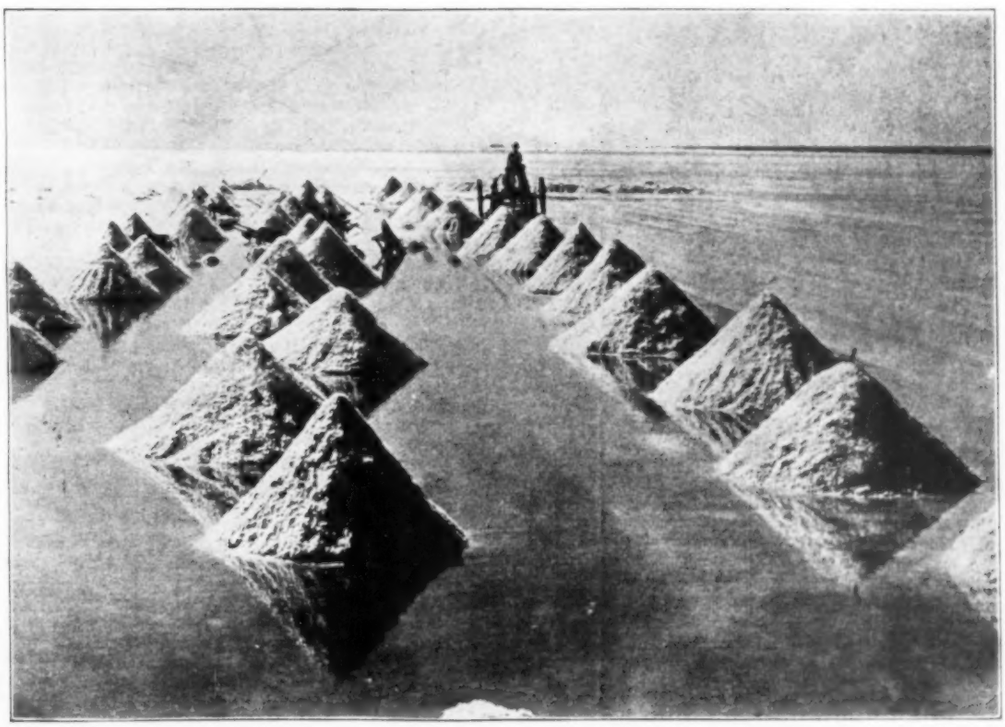
# Harvesting Salt in a Real Sea of Salt



**Scene Near Saltown, a Place Where the Water, the Ground and the Very Air is Salt, and the Women are Surprisingly Beautiful--See Next Page**

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Thin Bronze Desirable in Statuary.
An Eagle's Lifting Power.



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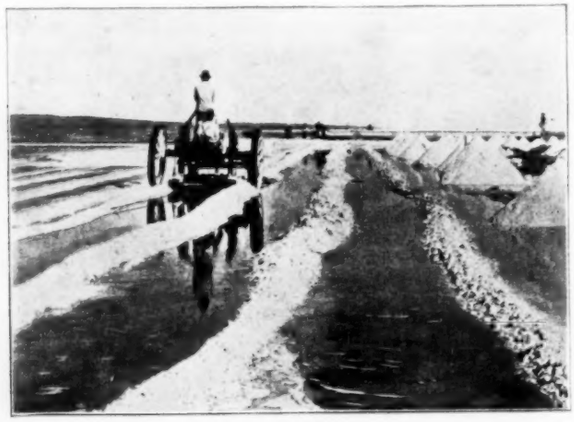
## SALTOWN, THE SALTEST TOWN ON EARTH.

### Salt Water, Salt Air, and the Ground is of Salt—Rare Beauty of the Women.

Saltown is a village in California where the manufacture of salt is the one commercial pursuit of all its inhabitants. It is near the Pacific, the saltest ocean of the world. But Saltown is located on a sea of salt of mysterious origin, and it is the most saltish place on earth. The inhabitants of Saltown are forced to drink an enormous amount of water to quench their thirst, and persons not accustomed to the conditions can scarcely endure the craving. The natives, though, enjoy good health, and the women are remarkably beautiful. The very air is saline, and the heat that rises from the salt seas and salt beds around is terrific.

Thus it is that in Saltown the farmers instead of plowing fields of corn and wheat plow fields of salt; the mills and factories instead of grinding grains and making flour or other



The Surface of the Marsh is a Mass of Salt.

commodities manufacture salt, wholesale dealers handle nothing but salt. The people there never buy salt to season their food. All they have to do is to go out in the yard and pick up all the salt they want, or the factories will provide them with all the refined salt they can carry away. Salt in Saltown is actually as cheap as dirt. So strongly tinctured with salt is the very flesh of Saltown's inhabitants that their bodies are said to remain preserved longer after death than those of any other people on earth.

Saltown in many respects ought to be entitled to rank as one of the wonders of the world. Everything about the place is strange and peculiar. The salt comes from a great marsh of 640 acres. This is down 230 feet below the level of the sea. It is on the Colorado river in Riverside county. Enterprise, that bright San Francisco monthly, in speaking of this strange place, says: "The surface of this marsh is one mass of salt, white as driven snow, and sparkling with pristine brilliance in the sun. By means of a steam plow the surface is scraped and the salt piled into cones. Probably nowhere else in the United States can such a sight be seen as this natural salt bed. How it was formed is still a matter for geologists to conjecture, one theory being that at one time the Colorado river overflowed its banks; another that the salt was deposited upon the subsidence of the waters which covered this section of America previous to the carboniferous period. However that may be, the supply seems to be inexhaustible, and the workmen there suffer constantly from an abnormal thirst."

The process of harvesting the salt and piling it into great salt heaps, containing from 300 to 1,000 tons, is shown in the accompanying illustrations.

A remarkable feature of Saltown is the beauty of the women living there. They seem to retain their freshness of youth until old age, and in fact never to grow old. Such beautiful complexions can be found in no other spot on the globe. A clear, transparent skin of opalescent hue such as beauty doctors' patients can never hope to attain, is a common heritage among the fair sex of Saltown. It is the air, so saturated with salt, that is supposed to bring about this remarkable condition. The beautiful complexion, however, will not come from a short residence at Saltown. It requires years to attain it, and the newcomer is more generally afflicted than benefited from a visit to this strange place, which is like another world—a world of salt.

## THE OLDEST LIGHT IN ENGLAND.

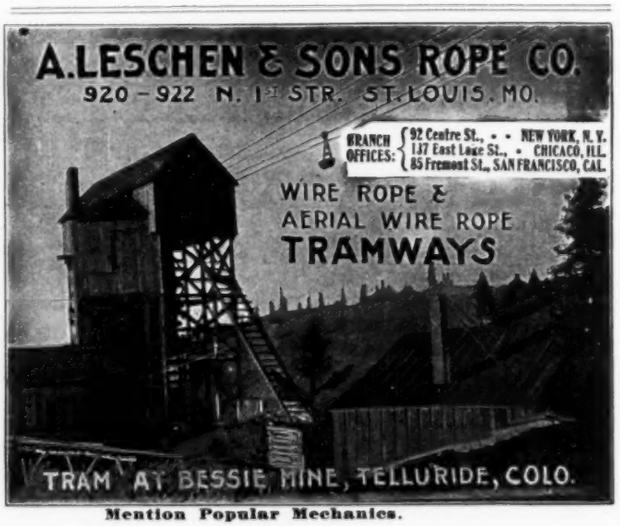
### Mariners Were Once Guided by a Coal Fire that Burned on Top of the Tower.

Probably the oldest existing lighthouse in England towers from the rock-lined coast of St. Agnes of the Scilly isles. Longer than 220 years ago this light was built and the self-same venerable structure, with a few modern improvements, stands until this day to guide mariners through the storm swept group of rocks in the English archipelago. The tower on which the light is perched is 70 feet high. A modified and improved development of the ancient catoptric light, placed at St. Agnes more than 100 years ago, throws its beam of 25,000 candle power to a distance of 19 miles.

But the "cresset," that originally and for many years was the sole illuminant, was a very inferior light to the present one. This identical cresset can still be seen in the gardens of the neighboring island of Tresco, where it is filled with scarlet geraniums, which form peaceful imitations of the flames it once contained. It is a large iron receptacle with open bars at the top and in it was burned a coal fire. In most cases where the cresset fire was used it stod on an open platform on the top of the tower. It was always totally extinguished during heavy rains or spray and when a strong wind blew from the sea all the fire would be blown to the landward side and the seaward front would give no light. At St. Agnes, however, the top of the light was inclosed in a glass lantern, but this, probably, made matters worse. There was not enough draft to make the coal burn well and the smoke would collect inside the lantern and dim the light and befoul the glass. The light was badly tended and often allowed to go out altogether. The Scillionians derived but a meager subsistence from their rocky isles and they regarded the wreck of a richly laden vessel upon their shores as an unmixed blessing. Wreckers they themselves are known to have been and the local weakness for wrecking on occasions affected the guardian of the light and the plunder of a lost ship has been found since in the coal that should have been burning to warn her from destruction. Hence when the light was most needed at St. Agnes there was generally no light to be seen.

## "DEAD MAN'S" HANDLE.

Dead man's handle is the latest and spookiest term among electric railway men. A number of serious accidents having occurred to electric cars as a result of the motorman fainting or losing consciousness from some reason or other, the concerns making the street car motors set about devising a remedy. A push button is placed in the top of the handle which operates the controller, by means of which current is let into or shut off from the car motors. As long as the motorman keeps the little push button down, the car runs along at whatever speed the controller may be set for; but the instant he lets go of the button off goes the power and the car will soon come to a stop of its own accord. The motormen don't like the scheme and fasten the button down with a little wooden plug and the value of the device is thus lost.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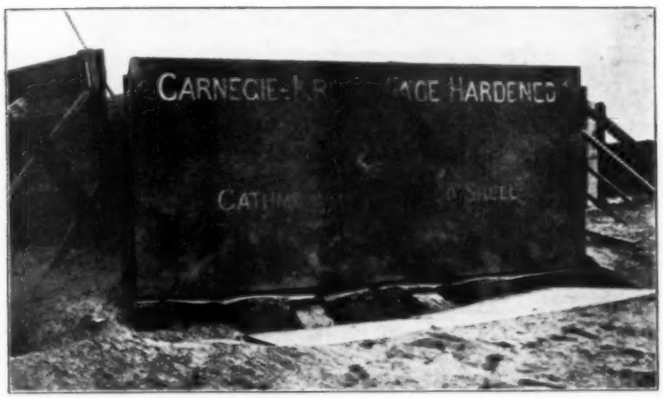
# New Gun Shells Can Destroy Any Warship that Man Can Build

## Conclusion of 40-Year Tests Shows Complete and Final Victory of Projectile Over Armor




Appearance of the Plate After First Gathmann Shot.

The struggle between projectile and armor, extending through a period of 40 years, beginning during the civil war, has ended in the complete victory of the projectile, seemingly, for all time. This means that no ship armor that skill of man can construct from the hardest metals known can withstand the awful force of the projectiles hurled from the United States 12-in. seacoast rifles of the present day, or probably of any day to come. No warship, however well clad in the hardest, thickest steel but can be pierced and blown to atoms by these projectiles. In the latest tests at Sandy Hook, which concluded a 40 years' series of tests, armor plates thicker and stronger than any that ever incased a war vessel were completely demolished. The requirements for tests were such that only such projectiles that were capable of producing these results were acceptable. A projectile fired from a 12-inch seacoast gun that will not wreck a battleship at the second or third shot has no place in the United States naval or army service at this time. This known, it is little wonder that the Spanish ships were so speedily demolished during our late war. The Sandy Hook tests also demonstrated that the United States regular army twelve-inch gun with its armor-piercing projectile, charged with the latest army explosive, is the most destructive weapon ever devised.

These tests of 40 years, which have cost the government many hundred thousands of dollars in appropriations, have quite revolutionized old methods and conditions.

Not only must the projectile now be capable of penetrating through the armor, but it must be filled with explosive and so arranged that it will detonate after having pierced the ship's steel side, so that it will work absolute destruction inside the vessel. A shell that would burst on striking the armor would be immediately tabooed by the government. The tests have also brought into service two explosives the like of which the world has never known before. They are known as Maximite and Explosive D. It is with these explosives that the shells are filled when fired at the vessels.

In the recent tests at Sandy Hook shells made by the Gathmann company were entered as competitors against the United States armor-piercing projectiles, the claim being made that the Gathmann were equal to any. The plates used were the Carnegie-Krupp face hardened, the hardest armor known to the world. The Gathmann company clearly defined what their shells and gun would do, and the navy and war department disputed the claims. The results of three Gathmann shots are shown in the first two illustrations. The first two shots did not materially injure the plates, and the third shot was fired at point blank range. As a result there was a vertical through crack eight feet distant from the point of impact, extending through a row of bolt holes and through the place struck by the preceding round. None or all of these shots would have seriously injured a vessel. The Gathmann shells each weighed from 1,834 to 1,840 pounds.

Then came the test with the 12-inch United States service rifle. The 12-inch armor-piercing shell was loaded with

Twelve-Inch Plate After Third Gathmann Shot.

19 pounds and 7 ounces of the famous Explosive D. The shell with the explosive weighed 1,001 pounds and 7 ounces. The shot struck the center of the target with a velocity of 1,800 feet per second, corresponding to a range of 4,400 yards, with 22,500 foot tons' striking energy. This shot penetrated the plate and detonated in the rear. The result of the shot is shown in Fig. 3. The backing, the skin plate, the frames and coffer dam plates were completely demolished in line of impact. The crater formed in the sand butt in the rear of the structure measured 15 feet by 1½ feet. Pieces of the plate and projectile passed through the structure, through the butt and were recovered from 150 to 200 feet in the rear. The firing of the other two shots is thus described by the Journal of the Western Society of Engineers, the great American engineering authority.

Twelve-Inch Plate After First Service Shot.

A twelve-inch armor-piercing shot weighing 1,006 pounds, with 23 pounds of Maximite, struck the right center with the same velocity and energy as before, detonating on the plates and completely wrecking the right-hand portion; it demolished the frames behind the armor and the plates of the cofferdam.

"Round 3.—A twelve-inch armor-piercing shell weighing 1,045 pounds, including 60 pounds of Explosive D, struck the lower left-hand corner with a velocity of 2,073 feet per second, corresponding to a range of 1,880 yards; the energy was 31,100 foot tons. The shell penetrated and detonated in the

plate; the plate was completely wrecked, and the backing, frames, beams and cofferdam plates of the structure demolished. An opening four feet wide by eight feet long was made through the plate; one large fragment about two by two and a half feet was hurled through the target and through the butt, being recovered 135 feet in the rear of it.

The act of Congress required that at least ten shots should be fired at the structure from the army rifle, but the annihilation of the structure by three shots made it impracticable. It may be said in this connection that the destructive effect of the twelve-inch army rifle surpasses anything hitherto obtained from any gun so far as records show.

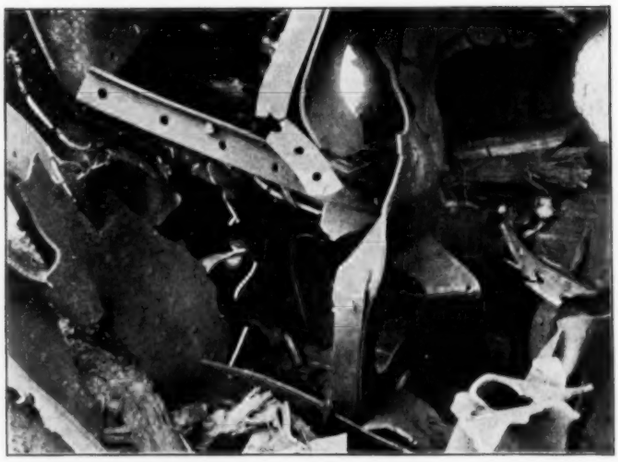
The requirements for a satisfactory explosive are:

1. The explosive must be chemically stable and not subject to deterioration in store.

2. It must be of convenient form for loading into shells, and the loading must not be attended by special danger.

3. It must be sufficiently insensitive to withstand the shock of discharge from the gun, and the tremendously greater shock of impact against the plate of the prescribed thickness, for example, a twelve inch plate, when fired in a twelve inch armor piercing shot.

4. Finally, it must be completely detonated after passing through the plate, by the service detonating fuse.



Rear View of Twelve Inch Plate After Third Service Shot

Front View of Twelve Inch Plate After Third Service Shot

## THE CARE OF LAMPS.

The following directions for the care of lamps are given by the Crockery and Glass Journal:

In lighting a lamp the wick should be turned down and left down until the chimney and shade are replaced; then gradually turned up. This will save the chimney.

A lamp should be extinguished by turning down the wick and then pulling the extinguisher. If there is no extinguisher, blow across the top of the chimney; never down into it.

Once in every two or three weeks the burner should be washed in strong soap suds or in soda water. Many persons boil them in soda water, but it is hardly necessary.

A few bubbles of air in the oil tank of a student lamp will often prevent a free flow of oil through the narrow pipe which carries the oil from the tank to the burner, causing the lamp to give a dim, yellow light. When filling the student lamp bear this in mind and fill the tank to the top, and if any air bubbles appear, break them.

The Canadian Manufacturer says: As heretofore shown in this journal, as far as British imports into Canada are concerned, especially in manufactures of iron, steel, machinery, etc., that country is "out of it" now and forever, and the preferential tariff does not help the matter. In a selected list of 84 articles, the value of all the imports into Canada last year, amounted to $23,500,000, of which Great Britain supplied less than 13 per cent and the United States more than 75 per cent.

## EARLY CANALS OF MEXICO.

### Fortunes and Lives Sacrificed in Former Achievements of Ancient Aztec Civilization

The completion of the great Mexican canal described in a previous issue of Popular Mechanics marks the culmination of efforts of centuries to protect the City of Mexico from menacing higher waters and to afford proper drainage. The old acqueduct from the Montezuma springs at Chapultepec, built by the Aztecs and improved by the Spanish viceroys, was one of the earliest efforts in this direction. "The history of the unnumbered centuries is measured in a degree," says one writer, "by the accumulation of the filtrate of the waters of this basin, collected in the dead seas or lakes of Mexico." Then there have been great dams built and all underneath the city may be found traces of forgotten efforts at a system of drainage and protection. Some of them were undoubtedly successful and very meritorious, but there were foreign invasions and wars that destroyed almost everything of the former Aztec civilization and left but the shattered ruins to tell of the advanced conditions that once existed.

A French Engineer, Henry Martin, was vested with the task of draining away the superfluous waters of the dangenerous lakes in 1607, and the great subterranean gallery of Nochistongo was begun in that year. No nation had a larger number of men, life long trained in mining, than Mexico and this experience especially fitted them for the great work. Fifteen thousand Indians were employed and the work was completed in eleven months, which gave a tunnel of nearly 5½ miles in length. Sixteen years later the tunnel was abandoned and the old system of dikes and dams was again put in order. The tunnel was closed, lest the water pressure on it should be too great and on June 20, 1629, in a single night, almost the entire city of Mexico was laid under water. For five years ensuing the water in the streets was so deep that canoes formed the only medium of street traffic. So great was the distress and destruction wrought that orders were actually given to abandon the city and build a new capitol in the elevated plain between Tacuba and Tacbaya, to which the waters of the lake, even before the conquest, had never been known to extend. It was finally decided to change Martin's tunnel into an open cut or canal, and the huge task was completed in 1789. The highest elevation necessary in cutting this canal varied from 150 to 200 feet, with a linear measurement of more than 3,600 feet. To obtain such an immense depth the width was necessarily from 250 to 300 feet. The entire length of the cut was 7½ miles, and yet all this immense mass of labor was removed by hand and carried on the backs of docile Indians and deposited on either bank. It is said that the lives of more than 20,000 laborers were sacrificed in this colossal work. All the public works were abandoned during the revolutions of 1810 and 1820 and the great canal became choked with debris. The city was devastated by another flood in 1865.

For the illustrations and data contained in this and the previous article we are entitled to the Journal of the American Medical Association.

See article on late guns in next issue.

# The Sailing Vessel for Beauty

## Modern Ocean Steamers Possess Speed and Conveniences But Not Good Looks

The modern ocean liner may have her many conveniences and good service for passengers and travel swiftly over the waters, but when it comes to appearance, the old-time sailing vessel makes one of them look like a jay bird beside an eagle. Just notice the sailing vessel in the picture, for instance! Wouldn't it be hard to find a steamer to compare with her? The Llewellyn J. Morse is this vessel's name. She is not noted for her cost or exceeding magnificence, but somehow when she anchors in the San Francisco harbor, she has a very stately appearance and demands a heap of respect. She has a majestic, commanding air about her and whether lying idle in the wharf or under full sail at sea she presents an imposing presence and every "fellow" that passes her looks on in admiration.

Unfurled Sails, San Francisco Harbor—From the Four Track News.

### LIVED ON SUGAR AND SAWDUST.

It has lately been discovered that a person can live on sugar as an exclusive diet. J. Jaquier, an engineer of Johannesburg, South Africa, during the late war was caught between two armies and was compelled to remain in his hiding place for six weeks with no food except a supply of sugar. He had six rabbits with him and he fed himself and the rabbits exclusively with sugar mixed with sawdust. All thrived on it and the rabbits grew fat.

### KILLING TURTLES WITH ARROWS.

Killing a turtle with an arrow seems a very difficult feat, since a very hard shell covers practically all of the animal, yet the natives of the Andaman Islands kill huge turtles with arrows as easily as American sportsmen kill rabbits with shot.

Accustomed from their childhood to bows and arrows, they often become wonderfully skilled in the use of these primitive weapons, and, as they know the places where the turtles congregate, it is easy for them at any time to bring home a good bag of game. Sometimes they try their skill on large fish, and, though the latter are harder to kill than turtles, there are a few islanders who rarely miss their mark.

### THANKS CANADA—YOU'RE RIGHT.

Popular Mechanics, published in Chicago, has had phenomenal success. It is just a year old, and claims to have a circulation of 20,000 a week. And it deserves it.—Canadian Engineer for January.

London has, in proportion to its population, more shade trees than any other large city.

### TRAVELING MEDICAL COLLEGE.

A traveling medical and surgical university has received the indorsement of Kaiser Wilhelm and is to be at once instituted in Germany.

Great specialists, such as Professors Lassar, Gergmann, and Rumpf, will charge small fees for their services. Professor Lassar already has contributed 1,000 specimens of skin diseases to the museum, which will be carried from place to place with laboratory appliances. The country doctor can thus come to his neighboring city for a week or two once a year and hear the leaders of his profession explain the latest processes for treatment or see celebrated surgeons operate.

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## HOW TO LAY PORTLAND CEMENT FLAGSTONE WALKS.

By F. H. Crafts, of State Engineer Corps, Rochester, N. Y., in Municipal Engineering.

The writer having had considerable experience with cement walks, both as engineer and contractor, has written this article to cover the answers to many inquiries concerning the details of their construction.

The materials required for a small job are six or eight scantlings of the best white pine, 2x4 inches x16 feet, dressed on all sides; half a dozen cross-heads, 2x 4 inches and as long as the walk is wide; some ash or oak ribbons, 3½ inches wide and 10 or 12 feet long, ¼, ⅜ and ½ inch thick, to be used in place of scantlings on curved walks; a small, round screen, having 64 meshes to the square inch; a large screen, 22 inches wide by 6 feet long, having 16 meshes to the square inch; an iron shod straight edge, 1½ feet longer than width of walk; many iron pins and wooden stakes; also shovels, hoes, axes, picks, steel squares, iron wheelbarrows, rakes, hammers, pounders, carpenter's level, finishing tools and a tool-box.

A careful and experienced man should have charge of the work, as errors and mistakes in this business are very costly, and there are many ways of ruining a walk. The lines and grades should be given by a surveyor, the stakes being set with the help of instruments. The foreman should make sure that all of the stakes are right. It is possible that a wrong grade has been used. It makes a very great difference about the cost of a walk whether there is good or bad management. It is of great advantage to have skilled help, especially a skillful finisher, in putting down cement walks.

Street walks should be made four inches thick. Inside walks are narrower and they may be thinner.

One barrel of cement is sufficient for forty-five square feet of walk. Only very high grade, slow-setting Portland cement is suitable for cement walks. One cubic yard of gravel is necessary for seventy-five square feet of walk, and must be clean and sharp. Sand is screened from the gravel with the large screen, and should not be coarse.

On wet and heavy ground, or where the winters are very severe, a foundation five or six inches thick, made of gravel or of soft coal cinders, sprinkled and well tamped, is necessary. Cinders make the best foundation.

A stout chalk line of seine twine is used in checking grades and lines when setting scantlings for a walk. Street walks have a slope of a quarter of an inch to the foot toward the curb, sometimes more. In parks and some other places, instead of a side slope, the walk is made crowning in the center. If there is a lawn between the curb and walk, the drainage and appearance will be greatly improved by setting the walk higher than the curb.

Concrete is mixed one part of cement by volume to six of gravel; top mortar is mixed one part cement by volume to two of sand; separator is mixed one part of cement by volume to four of sand; dryer is mixed one part of cement by volume to one of sand.

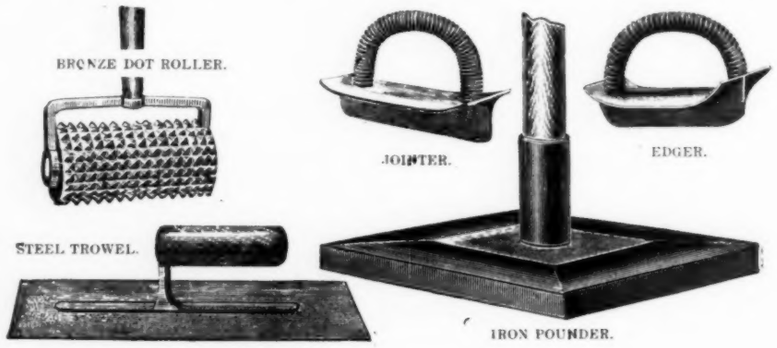
For the concrete, a good-sized box is used, the gravel and cement placed in it, and this is all mixed up dry, turned over four or five times, but not wet until ready for use, then sprinkled and turned over until all is damp; then immediately put in place with wheelbarrows. The top mortar is prepared at the same time, in another box, and in the same manner. The separator is mixed in a wheelbarrow dry. The dryer is obtained by screening equal quantities of cement and sand through the small screen, and mixing it dry and using it dry at the proper time.

In steps, driveways or crossings, where walks will have very hard usage, concrete should be mixed one to five.

The scantlings are placed in position with cross-heads between and plenty of stakes outside to hold them securely. Surveyors' stakes are good. Spaces are marked off on the scantlings, indicating the joints of the blocks, which should form rectangles (not squares) for good looks. Wire nails are driven in part way, on outside, opposite the joints, to refer to latter. The cross-heads are then placed at the joints, and secured with iron pins driven into the ground.

The concrete is packed in and well rammed until three and one-quarter inches thick, as shown by passing the straight edge over the frame, which is outside of the walk, and enough concrete is usually laid to make five or six blocks at once, if one has a large contract. This leaves three-quarters of an inch for the thickness of the top mortar. The iron pins holding the cross-heads are taken out long before the concrete is all in, and the cross-heads are held by concrete packed around them. After enough concrete is in place, the cross-heads are gently rapped with a small hammer, taken out carefully and the moist separator brought in with a shovel and well packed into the spaces left by the cross-heads, then rammed a little with a pounder. "Moist" means just wet enough to pack well. Some people do not use cross-heads, but prefer pieces of clapboard, cut down to three inches wide, and set on edge at each joint, narrow side up; these are left in the walk, and finally rot out.

Top mortar is next wheeled in and spread over the concrete quite soft and wet as compared with the concrete, which just shows moisture when pounded and must be wet enough to be worked easily under the trowel and straightedge. The latter, moved by a man on each side of the walk, pushing it back and forth, up and down the length of each block, renders it smooth and true; trowels are used all the while to prevent the waste or loss of good mortar over the sides of the scantlings. A steel trowel rubbed over the walk soon brings water to the surface, or at least moisture, which is taken up by a liberal sprinkling of the dryer. The dryer is carried in a pail and scattered by hand, then rubbed in with a float or wooden trowel.




Tools for Laying Cement Walk

The straightedge (one and one-half inches thick) is laid flat across the walk with the iron in line with the wire nails, in order to be exactly in line with the joints; a man, standing on this, and using a stout-pointed trowel, keeping the trowel always against the straightedge, cuts down through the walk, working all the way across, and finally passes his trowel back and forth from one side to the other, making a clean-cut joint, and does the same with the other joints. When clap-boards or tar paper are in the joints they are cut only one inch deep. Some one follows after, with the finishing tools, jointer and edger, and polishes up the edges. A plasterer's trowel is now used to give each block a fine finish. If the blocks happen to be wet, one must wait awhile, for a walk must not be finished wet. The atmosphere will quickly dry up some of the moisture.

When the dot roller is to be used on a walk, it looks better to have a border all around each block, four inches wide. A chalk line held taut on the walk at points already marked with a pair of steel compasses and pressed down firmly by passing a steel trowel carefully over it, makes a very clean-cut line. The chalk

line is then taken away. The walk should be rolled crosswise, not lengthwise. Walks must be well protected for several days after laying, and ought to be frequently sprinkled in very hot weather, if exposed to the sun. Wooden covers are often used. Sprinkling is a benefit in all cases. A very small steel trowel is useful in touching up bad spots. A bricklayer's trowel is the kind with which to cut joints. At the beginning of the day's work, a clap-board or a piece of tar paper three inches wide may be used against the walk laid last, or against any block that has been laid long enough to get very hard. Wet sand is good to place between a curbstone and cement walk, or against the stone walls of a house where a walk would otherwise touch them. Very wide walks are laid in several courses, but it is bad practice to break joints, blocks ought not to contain more than forty square feet unless made extra thick in the middle. It is better not to have more than thirty square feet in each block. Scantlings should not be removed until the day after the walk has been laid, and then rapped downward until loose.

Coloring matter may look very fine at first, but eventually fades, and then has a bad appearance. Very fine, broken quartz is sometimes mixed with the sand in the top mortar of cement walks to improve their wearing qualities. A name stamp may be used before the cement sets for marking the maker's name.

## World's Fair Home of Newspaper Men

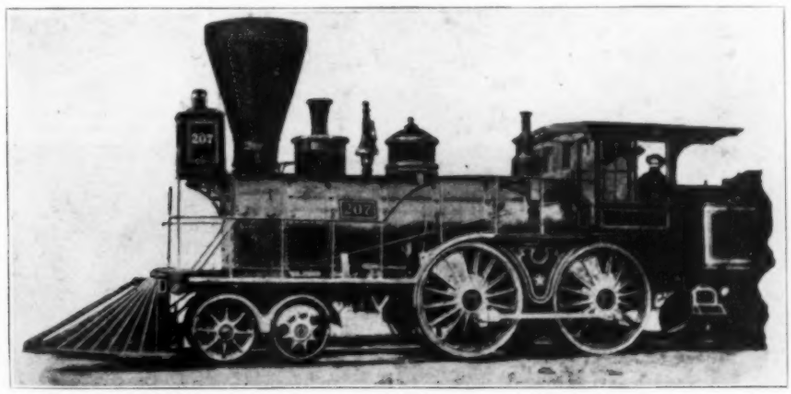
Press Building.

The Press Building at the St. Louis World's Fair is to be made the home of newspaper men during the exposition. It will be provided with adequate telegraphic facilities, desks, and everything to aid them in their work as well as to provide for their comfort. The structure stands in the northeastern part of the grounds, near the Liberal Arts building. It is built almost entirely of wood, and in architecture resembles the old homes and public buildings of the early days of the Louisiana territory.

## What Engine First Burned Coal?

### The Distinction Claimed by So Many that a Contributor Finds Himself Nonplused

Editor Popular Mechanics:—In the letter by Mr. Vinton Stillings on the subject of old time engines which appeared in Popular Mechanics of Feb. 21, I think he expresses a wish which is shared by many others when he wants pictures of old locomotives of the fifties. I have collected several such pictures, as this subject has always been of great interest to me, and I enclose a small cut of an old inside connected engine with railing all around the boiler. The picture from which I made this copy is 7½ by 4¼ ins. I have not the history of this engine, but it ran on the Baltimore & Ohio. In studying the development of American locomotives, I find one subject on which there is great difference of opinion and that is as to the advent of the first successful coal burner. Mr. S. M. Vauclain in the articles that ran in Popular Mechanics last spring, entitled, "Locomotives of a Century," says in the paper of May 3: "His (Winans) engine shown in Fig. 20 was built in 1846." "It was the first locomotive to burn anthracite coal successfully, and thus enabled the Reading Railroad to haul coal to Philadelphia by burning coal instead of wood." In the next paper of May 10, we find this statement: "We now come to the first engine to burn anthracite coal, which marks a distinct step in the wonderful evolution of the locomotive." "It was James Melholland's 'Illinois' shown in Fig. 25." An article in "Railway and Locomotive Engineering" of last August claims that an engine named the "Daniel Webster" built by direction of Mr. S. M. Felton some time in the late fifties for the Philadelphia, Wilmington & Baltimore road was the pioneer coal burner.



Old B. & O. Inside Connected Engine—Photo by. J. M. Kimball, Woburn, Mass.

My curiosity being now aroused I consulted some authorities in the Boston Public Library. A book by Daniel Clarke and Zera Colburne entitled "Recent Practice in the Locomotive Engine," says on page 69, "In 1836 anthracite coal was adopted successfully in the engines of the Beaver Meadow Railroad, a line extending into an anthracite district."

In "Modern American Locomotive Engines," by Emory Edwards, the following statement appears (page 143): "In the year 1849 Ross Winans of Baltimore, built a single locomotive for the Boston & Worcester." "It was for an experiment in coal burning and was constructed to burn anthracite coal." "This locomotive was named the 'Carrol of Carrollton'." "It ran between Boston and Albany and made a mile a minute with ease." By this time I was somewhat bewildered by taking up Browns, "The History of the Frist Locomotive in America" (W. H. Brown, New York, 1871). I concluded they would all have to take a back seat. On page 178, this extract from a letter by Mr. Matthew, who was the engineer of the "De Witt Clinton" (1831) appears: "This engine weighed about 3½ tons without water, and would run 30 miles an hour with three to five cars on a level, with anthracite coal and was the first engine to run in the state of New York on a railroad." Last of all on page 84, of the same book, it says that the old "Stourbridge Lion" burned Lackawaxen coal on her trial of machinery on the wharf in New York, where she was horsed up for the purpose in June, 1829, and the record says "Steam was sustained (although there was no friction) at between 40 and 50 pounds to the square inch." Thus we see that the "first successful coal burner" is more numerous than "the oldest Mason."

J. M. Kimball.

76 Garfield Ave., Woburn, Mass.

# Easy Electrical Experiments

By L. P. Dickinson

## HOW TO MAKE AN ELECTRIC GYROSCOPE.

The gyroscope has long been known to physicists as an interesting scientific toy. In an elementary form it has been used probably by many of the young readers of this paper. The form usually sold in toy shops, consists of a lead wheel with an extremely heavy rim mounted in a pair of pivots supported on a ring. When set into extremely rapid rotation by means of a string wound around the axis, the wheel may be made to perform numerous interesting feats such as hanging by one side from the edge of a table or other convenient support. The common top so dear to every boy's heart is only a special form of gyroscope. Every one knows that as a top spins rapidly it will stand upon its point in apparent defiance of the law of gravity, and if displaced from its position will tend to assume an erect position again. If we take a bicycle wheel from its frame and grasp the supporting axle in the two hands, we may tilt the wheel easily to any angle provided the wheel be at rest. If however, we set the wheel spinning quite rapidly and then try to change the direction of rotation of the wheel by grasping the axle, we shall find that it is almost impossible to suddenly wrench the wheel out of its normal position.

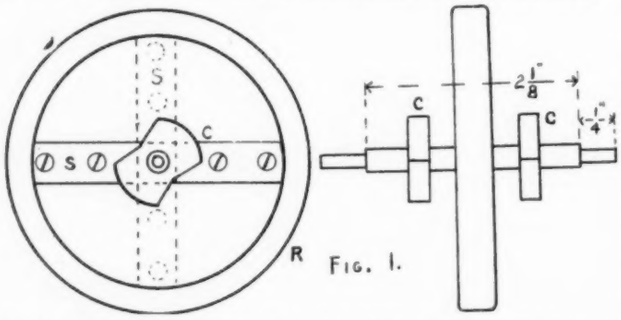


Fig. 1.

In all these cases, it is apparent that a body in rapid motion possesses properties which a body at rest does not possess. They are only specific illustration of the important law of motion which states that a body once set in motion cannot of itself change either the direction or the value of its own motion.

In the case cited the motion soon ceases and the effect is, therefore, only a temporary one. In the instrument to be described in this paper electrical means are employed to keep the body in constant rotation, thus making possible the demonstration of many interesting physical facts. One of these which is of especial interest is the visible demonstration of the rotation of the earth upon which we live. We ordinarily accept as true that the earth rotates on its axis; the gyroscope makes this rotation a visible fact.

We will need first of all, a heavy brass wheel such as is shown in Fig. 1. This wheel is 3 inches in external diameter and has a heavy rim ¼ inch thick, the width of this rim being ⅜ inch. The wheel may be turned from a ⅜ inch plate of brass. Especial care should be taken to accurately center and turn the wheel. The central portion of the wheel should be turned down to a thickness of ⅛ inch, the rim being of the dimensions already given.

On one face of the wheel and within the rim, is to be mounted a piece of soft iron shown at S which is 2½ inches long, 7-16 inch wide and 1-16 inch thick. It is fastened in place by four flat head iron screws counter sunk flush with the surface. On the other side of the wheel and at right angles to the first piece of iron is mounted a second piece indicated by the dotted lines.

Having done this, bore through the exact center of the wheel a hole which is a scant ¼ inch in diameter. Through this hole is to be driven very tightly a shaft whose total length is 2⅝ inches, the wheel being in the exact center of the shaft. The shaft is turned down for ¼ inch from each end to a diameter of ⅛ inch thus forming two shoulders to fit in bearings to be described later. If any doubt exists as to the shaft being exactly in the center of the wheel a test should be made at this point and the wheel turned down by taking a very light cut until both inside and outside of rim run perfectly true.

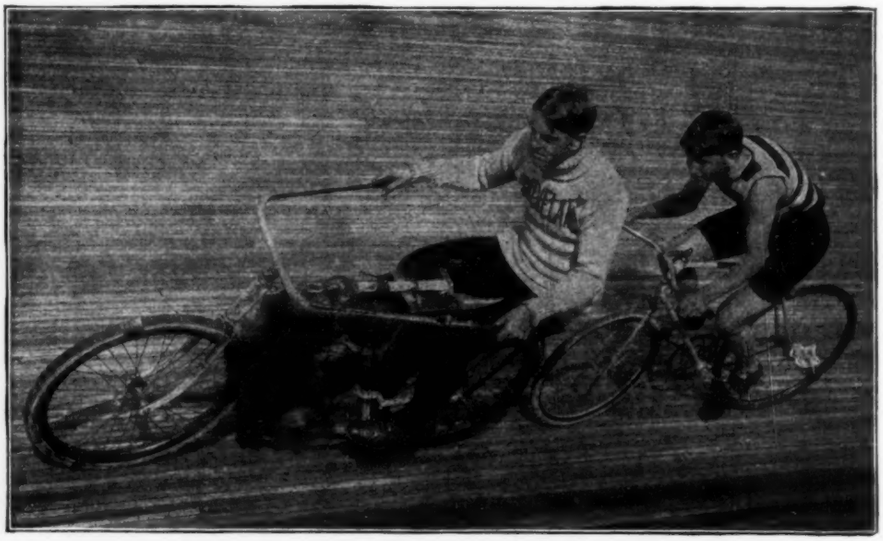
At C are shown two contact wheels made of 3-16 inch brass driven tightly upon the shaft. These contact wheels are so made that they will make contact with a brush which is to press upon them for one-fourth of a revolution, then break the contact during the next quarter revolution, then make contact during the next quarter and so on. Accordingly they have the shape shown in the left hand part of the figure, the diameter measured between circular portions being ⅞ inch. They should be placed in the position indicated in the figure, the discs on opposite side of wheel being twisted around so as to be at right angles to each other. This point will be explained more fully later, after we have built the remaining parts of the machine.

(To be continued next week.)

Montreal manufacturers of waterproof clothing have asked for protection against the "slaughtering tactics of the United States manufacturers," whom they claim are flooding that country with goods at a price which would about cover the cost of the cloth.

## FOOT POWER VERSUS MOTOR BICYCLE.

Joe Nelson, the famous bicyclist, used to be able to ride an ordinary wheel fitted with D. and J. hangers and keep pace with the fastest motor bicycle. The accompanying illustration shows the champion in the performance of this remarkable feat. Nelson is in the rear following directly in the path of the automatically propelled vehicle that is sweeping along the course with the speed of the wind. The photograph, in itself, is a novelty, being taken from a gallery while the riders were traversing the floored course. It is the only picture of a bicycle race on record to give this interesting view of the contestants. The angle of vision is such as to not only give a clear view of the wheels and forms of the riders, but it gives with remarkable accuracy the expressions on their faces while in the heat of the race.



Keeping Up With the Motor Wheel

# The Americanization of Jamaica

## A Fair Island, Owned by the English, Whose Commerce is Controlled by Americans

This is the season when the northern men's fancy lightly turns to thoughts of the tropics, the lands where no snows ever fall, where no blizzards ever blow; and Jamaica that beautiful "island of springs," is the destination sought by many of the southward bound. Jamaica belongs to the English but the Americans are doing more towards its development than all of the other foreign or local influences combined. The Americans control most of the leading enterprises on the island; the Americans buy nearly all of its fruits; the Americans have built its greatest wharfs; storage houses; freight houses and hotels the Americans spend more money with the Jamaicans than all the other nations combined; ten American tourists are seen in Jamaica to one of any other nation, not excluding English; the American steamships carry on the great fruit traffic in and out of Jamaica and unite it socially and commercially with the outer world. Were it not for America Jamaica would be almost a tropical wilderness. To the contrary, however, it is now one of the most prosperous neighboring islands. The Americans ought to own Jamaica; the Americans would own Jamaica if Jamaicans had the say; the Americans may own Jamaica some day, and when they do, Jamaica will become even more prosperous and delightful.

Probably the greatest influence in the development of Jamaica has been the enterprising American Corporation, the United Fruit Company. Their steamers that ply between Philadelphia and Jamaica are among the finest to be seen in tropical waters. They have built up the great fruit trade that now exists between this country and the island. They have introduced American methods of business into the island; added to the harbor and shipping facilities; made the island familiar to thousands of Americans who have traveled over their line, and made it easier for the Jamaicans to live than it used to be before the establishment of the pleasant commercial relations between Jamaica and this country. An idea of the modern accommodations and conveniences afforded by the United Fruit Company's steamers may be obtained from the accompanying illustration showing a dining room on one of their principal steamers. About all a person sees in Jamaica to remind him of England are the English coins.

Shipping Bananas

Dining Room, Admirals Sampson and Schley

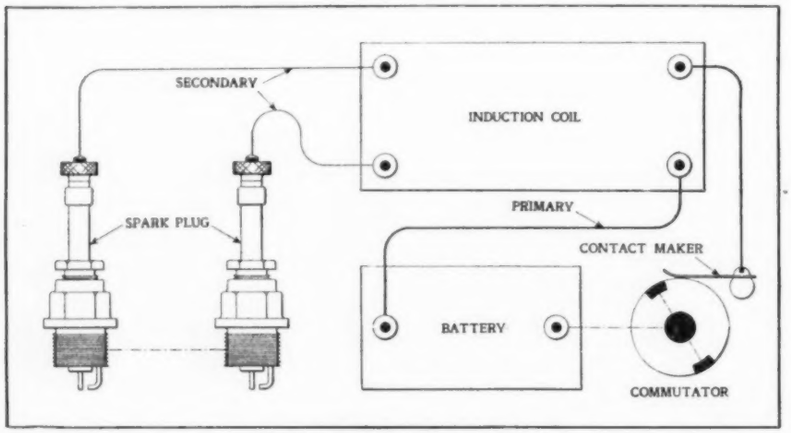
### GOOD RUN ON THE MICHIGAN CENTRAL.

On the Michigan Central railroad recently a single locomotive hauled a train of 16 passenger coaches, weighing more than 605 tons, from Bridgebury to St. Thomas, a distance of 119 miles, in 127 minutes. The average speed was thus nearly 60 miles an hour, although there were eight slowdowns on the journey. The highest speed attained at any point was 67 1-2 miles per hour.

# SHOP NOTES

## TWO CYLINDERS, ONE COIL.

A simple method of sparking both cylinders of a two-cylinder gasoline motor with only one coil is illustrated in the accompanying diagram from the Motor Age. A single commutator is used, with two contacts, but with only one brush or contact maker. The primary wiring is connected as if only one cylinder were to be used, while the secondary wires are connected, one to each of the terminals of the plugs, thus connecting the plugs in series with each other.




Igniting Two Cylinders With One Coil.

This method of wiring gives simultaneous sparks in each cylinder—in one cylinder just before the commencement of the explosion stroke and in the other cylinder just before the completion of the exhaust stroke. Although only one spark at a time ignites an explosive mixture, the idle spark occurs harmlessly in the other cylinder. The spark, therefore, has to jump across from one insulated terminal through the ground on the motor to the other insulated terminal to complete the circuit. The object of this arrangement is two-fold. It causes the times or points of ignition in the two cylinders to correspond exactly. Also, the presence of oil or other impurities on the points of the plugs is rendered far less detrimental by this arrangement, as the intensity of the spark is increased by it having to jump across two air gaps.

For a two-cylinder motor with both pistons connected to one crank pin, the contacts on the commutator should be diametrically opposite, or 180 degrees apart. For a two-cylinder motor with cranks at 180 degrees the commutator contacts should be set 90 degrees apart.

## TO MAKE A KNIFE CLEANER.

Cover an old knife board with a strip of brussels carpet. Thickly cover the board with powered bath brick and keep an end of it wet. First rub the knives on the wet brick and then finish off on the dry. Knives are polished well and quickly in this manner.

There are now in Italy 2,111,000 spindles of all kinds, more than 60,000 steam driven looms, and about 18,000 hand looms.

## SOFTENING A BELT.

We had in our closet a stout 6-inch belt that had lain there about seven years, says a writer in Power, and was about as dry and hard as leather ever gets. We had used two or three different preparations to soften belts and keep them from slipping, with the usual results of gummy belts and stuck-up, dirty pulleys; so we thought we would try a little old-fashioned neatsfoot oil. Taking a wide, shallow iron bucket, we put in about 2 gallons of water and ½ gallon of oil; then heated it just so it was bearable to the hands, and two of us passed the belt down through the oil and water on one side out at the other, scraping off the oil with our hands as it came out. The softening effect was surprising. The next day it was put on, and the men who set the motor pulled it as tight as a fiddle string. In a few days I noticed that the rivets were starting a little, and slacked the belt by moving the motor nearer the engine. This did so well that I slacked it still more, till now the lower part of the belt can easily be slapped against the upper. The distance from pulley centers is 12 feet; pulley on motor, 5 inches; on engine, 22 inches. The treatment we gave the belt keeps it soft and pliable, and after a month's use it is clean and the pulleys bright, with no perceptible slip with any load we have yet put on it.

## ANNEALING TOOL STEEL.

For annealing at the forge, says Sparks, take a piece of pipe and plug one end; place it in the fire and cover with soft coke; afterwards with a thin layer of damp coal. Leave the open end of pipe towards you, and when red hot check the blast and insert the article to be annealed. Turn the pipe occasionally so that the heat will be equalized.

When the steel arrives at blood red heat remove it and bury in dry sawdust. The latter must be dry, not damp. Do not remove the steel until cold. This takes considerable time, as the cooling is protracted. I am not much in favor of hardening large articles from the smith's forge, owing to the injurious action of the blast and the inferior quality of the fuel used.

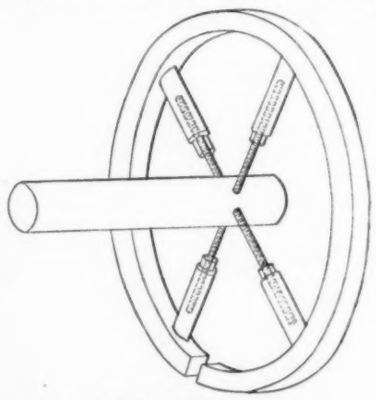
## SATIN FINISH FOR ALUMINUM.

In reply to a question presented by a manufacturing company who ask for a formula for putting a satin finish on aluminum sheet, the Metal Industry gives the following:

There are two methods of accomplishing this—viz.: By dipping and by the use of a wire scratch brush. 1. By dipping. This is accomplished by first dipping the aluminum in a warm solution of caustic soda and leaving it until bubbles come off from the surface. The sheet is then washed in running water and dipped for a moment in an aquafortis solution. This acid (nitric acid) should be free from copper—i. e., that used for dipping brass should not be used. The metal is then washed or rinsed in water and dried in boxwood sawdust. The success of this method depends upon the length of time that the metal remains in the caustic soda solution. A few trials will demonstrate the necessary length of time. This method, however, while giving good results, brings out all the imperfections in the metal, such as streaks, pits and similar blemishes. For sheet which shows these the second method is far preferable. 2. By the use of a wire scratch brush. This brush is simply a wire brush in the form of a wheel and is composed of very fine steel or brass wire. The wheel is revolved on a spindle, such as is used for buffing, and the friction of the ends of the wires produces the desired effects. With aluminum, steel wire brushes give better results than the brass. Very beautiful results may be obtained by skillful manipulation of the brush. It is said that sand blast also gives excellent results, although we have not had any experience with it in this direction.

## PUTTING ON PISTON RINGS.

The accompanying sketch shows a method of putting snap rings on to the piston of a steam pump, says Power. Take a 2-inch pipe, drill four holes one inch from the end. Take four bolts that are threaded full length. Place the taper end in the holes in the 2-inch pipe, the other end in a small pipe the end of which rests against the inside of the ring. Nuts are placed on these bolts, as shown in the sketch. Now, by screwing the nuts against the ends of the pipe, the ring is made large enough to slip over the piston easily. This will be found to be much handier than pinching it on to the piston with bar or chisel.



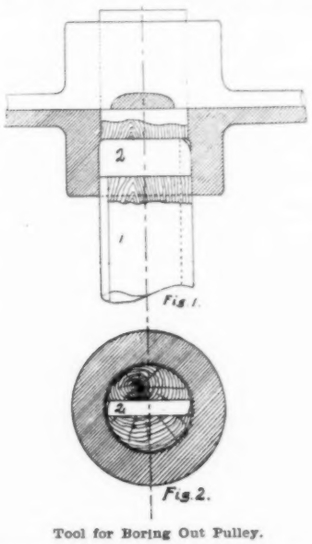
Putting on Piston Rings.

## TO COAT IRON WITH ZINC.

To coat an iron object it should first be well brushed and the verdigris removed; it is then immersed in a bath containing a concentrated solution of sal-ammoniac and granulated zinc; the object is boiled for a few minutes and then withdrawn. The adherence, regularity and whiteness of the zinc deposit can be increased by adding soluble salts of magnesium and mercury to the bath. This addition prevents the oxidation of the objects.

## TOOL FOR BORING OUT PULLEYS.

A home-made tool for boring out pulleys is thus described by a correspondent in the American Miller: I hand you herewith drawings of a tool for boring out pulleys, which does the work as nicely as can be done in any machine shop, and will be found a very handy tool for such work, especially by those who are located in the country and are miles from a shop where they can get such work done. It can be made by any one in a short time. In making it I use a stick of hickory timber, 1, turned or dressed out with about 6 inches of the top part to fit the bore of the pulley, with the remainder the size I want to bore it to. I set the bit, 2 (made from an old file with both ends made to cut), with the top or cutting edge about one-sixteenth of an inch above the offset. By mortising a hole through that the bit fits snugly with room at the bottom for a wedge to fasten it tight. In using it, I screw it in a vise in an upright position and set the pulley on and turn by hand.




Tool for Boring Out Pulley.

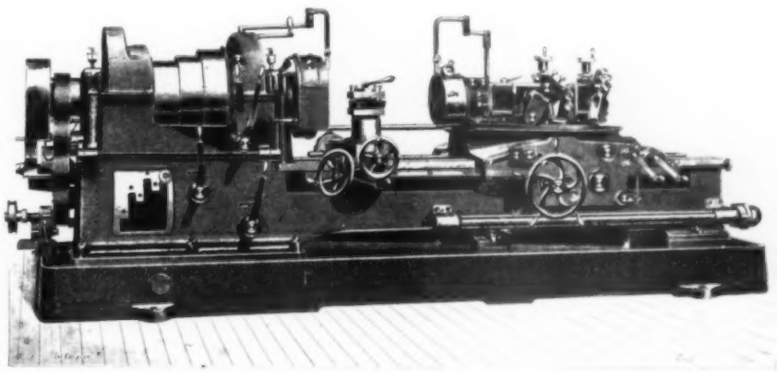
It is surprising how quickly you can bore out one-sixteenth or one-eighth of an inch, and if the bit is made exactly the right length, you will find the work to be well done.

## WIRELESS OFFICE ON A TRAIN.

President Newcomer of the New York Central railway has given permission to the De Forest Wireless Telegraph company to equip the Twentieth Century Limited train with wireless apparatus. The experiments will continue for two months, beginning April 1.

## LARGEST TURRET LATHE IN THE WORLD.

What is believed to be the largest turret lathe ever built has just been made by an English concern, for work on marine engines. The Engineer, London, gives the following description: The hole through the spindle is large enough to allow a 5-in. roller bar to pass easily. The front bearing is 8½-in. diameter, and the back 7¼-in. diameter, the difference being made to accommodate the thrust collars. Both bearings are parallel, and have hard gun-metal liners. The spindle is driven either direct or through back gears having ratios of 8 to 1 and 24½ to 1. There are three steps on the cone, 18-in., 21-in., and 24-in. diameter, and the belt is 5 ins. wide. There are two speeds on the countershaft so that a total range of eighteen speeds is available, and of these six are changed by friction gearing. Both back and front ends of the spindle are provided with chucks, the former simply steadying the bar, whilst the latter, which has four jaws, grips the work.



5-Inch Bar Flat Turret Lathe.

The bed is a strong ribbed casting, 13 ft. 6 ins. long, cast in one place with the headstock. It has flat shears with square edges, 26 ins. wide over all. The casting of the headstock and bed in one piece is an excellent arrangement, which we are glad to note is being increasingly adopted. If for no other reason, it would justify its existence by absolutely preventing the sinful practice of moving the headstock sideways to do taper work. We need scarcely say that in large lathes the rigidity of the arrangement is the main consideration.

The turret has independent screw-cutting and traversing feeds. The former is effected by a set of standard leading screws; the latter by a central shaft driving a cross shaft with steel pinions gearing with two steel racks, one on each side of the machine. The tendency to twist and bind which is present when the traverse is effected by a one-sided drive is thus entirely obviated. There is also a quick-power traverse. The feeds for the turret are twelve in number, ranging from 10 to 216 turns per 1 in. of traverse. The weight of the lathe complete is 12 tons, and the floor space occupied is about 16 ft. by 5 ft.

"Money and time are the heaviest burdens of life, and the unhappiest of all mortals are those who have more of either than they know how to use."—Johnson.

## ATOMIZERS FOR LIQUID FUEL.

In using oil fuel in marine service the use of steam for atomizing is important, and this was the subject of careful attention by the "Liquid Fuel Board" of the navy department, says the American Engineer. It was found that with steam atomizing burners the averrge percentage of steam required for the burners was about 4⅜ per cent of the entire evaporation of the boilers. Such a consumption of water that must be made up by evaporators on shipboard leads to the use of air as an atomizing agent. Concerning the matter of steam in the flame, the recent report of Rear Admiral Melville states that there is quite a widespread misconception regarding the part that the steam which is used for atomizing purposes plays in effecting combustion. It is supposed by many that after atomizing the oil the steam is decomposed and that the hydrogen and carbon are again united, thus producing heat and adding to the heat value of the fuel. While it may be true that the presence of steam may change the character and sequence of the chemical reaction, and result in the production of a higher temperature at some part of the flame, such an advantage will be offset by lower temperature elsewhere between the grate and the base of the stack. All steam that enters the furnace will, if combustion is complete, pass up the stack as steam, also carrying with it a certain quantity of waste heat. The amount of this waste heat will depend upon the amount of steam and its temperature at entrance of the furnace. The quantity of available heat, measured in thermal units, is undoubtedly diminished by the introduction of steam. In an efficient boiler it is quantity of heat rather than intensity that is wanted. For many manufacturing purposes intensity of heat may be of primary importance, but in a marine steam generator a local intense heat is objectionable on other grounds than those of economy, viz., its liability to cause leaky tubes and seams from the unequal expansion of heating surfaces.

## TO MEND A TEAR IN A MACKINTOSH.

Make a cement by dissolving some shreds of India rubber in naphtha, adding enough to make a stiff paste. Apply some of the cement to both edges of the torn place, and quickly bring them together on a flat surface. Place a flat iron over the mended spot and let it stand until the cement is hard.

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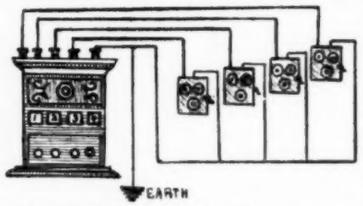


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# Milking by Machinery

## Mechanical Device that Imitates the Motion of the Calf in Sucking

Milking by machinery is an innovation that has recently been placed in service in some of the large dairies. The device which sucks the milk from the cow is said to be modeled after the motions of the calf, the best cow milker that was ever invented. One machine will do as much work as four milkers and hence it is a great economy on dairies where large numbers of men are employed. The machine is called the "Sympathetic Pulsating Lactator." In describing it Hoard's Dairyman says:

Milking Machine and Bucket

The machine can be used to best advantage with a dairy of fifty cows or over, as it requires an engine or other power to drive it. A vacuum air pump is located at some nearby point convenient to operate it. From this a line of iron gas pipe is run above the cow stalls in the milking shed. The only service of this pipe is to exhaust the air in the milk bucket, no milk or other liquid being run through it. A small branch is fitted over each stall, and is formed into a hook on which the milk bucket hangs, a foot or two above the cow's back.

The bucket is air tight, the top being closed with a lid which is clamped securly into place by the simple act of raising the handle to lift the bucket. The mere hanging of the bucket on the hook is all that is needed to make the connection with the air pipe.

The teat cups are attached to a rubber tube, and in the center of them a small valve no larger than a hen's egg where all the regulating is done automatically. A turn of the handle under the valve sets the machine to work, and the resulting suction holds it in place until it is removed after the milking is finished. The valve and teat cups weigh but 33 ounces, and one man can use four or five or them to advantage on a string of cows. By the time he has the fourth one in place the first has finished its work and is ready to put on a new cow.

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Containing more than 500 illustrations of everything used in telephone construction, electric bells, all kinds of electric signals, batteries, construction tools, wires, cables, etc., the new catalogue—No. 16—issued by the Farr Telephone and Construction Co., 118 and 120 West Jackson boulevard, Chicago, is one of the handsomest as well as the most instructive ever compiled by an American firm. To the person interested in practical electrical matters, such as are met with in every day life, the catalogue will be found of immense value. The company announces that copies of the catalogue will be sent free of charge to readers of Popular Mechanics who mention this offer.

Much valuable land now under irrigation has been spoiled by seepage and the resultant deposit of alkali, and the process is still going on in certain quarters at a rapid rate.


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### THE BOY FROM TOWN.

Last night a boy came here from town
To stay a week er so,
Because his maw is all run down
And needs a rest, you know.
His name is Cecil, and he's eight,
And he can't skin the cat.
His maw she calls him "Pet." I'd hate
To have a name like that.

He wears a collar and a tie,
And can't hang by his toes;
I guess that I would nearly die
If I had on his clo's.
He can't ride bareback, and today,
When we slid on the straw,
He ast if roosters help to lay
The eggs I pick fer maw.

When our old gander hissed, he ran
As though he thought he'd bite,
And he ain't ever shot a gun
Or had a home-made kite;
He never milked a cow, and he
Can't even dive or swim;
I'd hate to think that he was me;
I'm glad that I ain't him.

He thinks it's lots of fun to pump
And see the water spurt,
But won't climb in the barn and jump
For fear of gettin' hurt.
His clo's are offl nice and fine;
His hair's all over curls;
His hands ain't half as big as mine;
He ought to play with girls.

A little while ago when we
Were foolin' in the shed,
He suddenly got mad at me
Because I bumped his head.
There's a lot of things that he can't do;
He thinks that sheep'll bite,
And he's afraid of ganders, too,
But he can fight all right.

—Thresher World.

### THINGS OUR READERS WANT.

I would like the address of a firm that sells small water motors with sufficient power to run a sewing machine.—Chas. A. Onion, 210 W. Grant St., Minneapolis, Minn.

Please tell me where I can procure tools for working designs in brass.—A. Shelton Pennoyer, Agassig Hall, Alta, Cal.

I desire to correspond with makers of or dealers in cast steel crank shafts for gas engines, either in the rough or finished; something that would be suitable for 1 to 12 h. p.—O. W. Stevens, Richmond, Ind.

Please give me the address of some manufacturer or dealer in bicycle repair outfits. Yours with kind wishes for Popular Mechanics.—W. F. Bailis, Roswell, N. Mex.

Being a subscriber to your paper and a great admirer of the same; I think it is a fine paper and should be in the hands of every man, young or old. Will some of your readers inform me what kind of a tool the Winchester Repeating Arms Co. use in boring out their shot guns? I would like to have a sketch of same. I have some choke boring tools, but they are ring borers. Can any one give me the reason of this? If any of your readers can suggest a good tool for this work I will be glad to hear of it through your paper or otherwise.—Henry Slotter, Lakeport, Cal.

Please give me the address of some firm dealing in supplies for electro plating.—J. W. Walker, Magnolia Springs, Ala.

### SMOKELESS COMBUSTION.

The space above the fire bed should be devoted entirely to the completion of combustion before the gases come in contact with any cooling surface. The combustion in your gas jet or lamp flame is complete and perfect. Hold a test tube of water in the flame and note the immediate deposition of unconsumed fuel upon it, says the Engineering Magazine. Hold a coil of wire about a candle flame and watch it go out. These experiments were once known to most of us, yet we placidly set our horizontal tubular boilers 28 inches above the grate and wonder why we get smoke. And as though that was not bad enough, we have in the wonderful strides of progress of the past decade, built water-tube boilers in which the gases and flame rise from the grate and plunge immediately through a high bank of tubes. I am informed by a maker of both horizontal and vertical water-tube boilers that the former, with the fire directly below in the tubes, is more efficient for hard coal, and the latter, with an exterior furnace, for soft coal. The reasons are not hard to find. We are told that radiation is the most efficient method of transmitting heat; hence, the advantage of the horizontal boiler with the tubes directly over the fire. With hard coal having a short flame, combustion is practically completed before reaching the cool tubes. But with soft coal, more is lost in the horizontal boiler by the dampening of the flame than is gained by direct radiation to the tube surface. If a furnace could be devised in which the advantage of direct radiation could be retained while the gases were kept from contact with all cooling surfaces until combustion was complete, we would make a long stride in advance.


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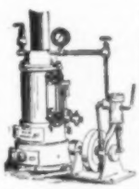

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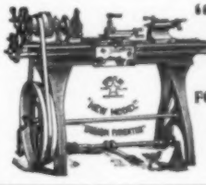

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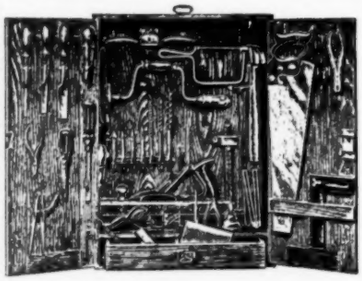

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## ADVANTAGES OF A FARM TELEPHONE.

Before breakfast the farmer discovered that some of his cattle had broken out of a pasture and were missing, says the Thresher World. He began telephoning to his neighbors, and within five minutes had the strays located. Without the telephone he would have put in two hours looking for them.

A few minutes later a half bushel of peaches which had blown from the trees during the night were brought in, and it was evident that they must be put up right away in order to save them. The housewive had not a sufficient supply of sugar. It required only a minute to telephone to town, five miles away, and the rural delivery carrier brought the sugar out two hours later.

The farmer intended to put up hay, but before doing so he telephoned to the postoffice, where the government weather report was received daily by telegraph, and asked what the weather indications were. He was told that storms were threatened. As a consequence he did not cut his hay, and probably avoided a considerable loss.

The farmer's wife wanted to put up her peaches in a new way, but had forgotten the recipe. It required only two minutes to telephone to her sister, three miles away.

A bunch of cattle were driven past the farm, and were noticed by the farmer. Fifteen minutes later a telephone message announced that some cattle had been stolen the night before over in the next county. The description tallied with those the farmer had seen. Within two hours the thieves had been captured and the owners of the cattle notified by telephone where he could find them.

## MACHINES THAT SEEM TO THINK.

The home of the dipper dredge is on the Great Lakes. There it flourished and in the smaller sizes and in non-tidal fresh water at 20 feet depth was marvelously efficient, says the Engineering Magazine. A good wooden dredge of ten years ago which cost, say, $30,000, would do 1,500 or 2,000 cubic yards per 10 hours with a crew of six men on three tons of coal.

It could lift its spuds, move up, and reset again in 90 seconds. It stands alone like a table of its legs, with no moorings to obstruct navigation. By means of its dipper on the bottom it can move itself about crab-fashion in any direction, and by the same means can push the barges about which it is loading. It can maneuver itself in any direction, load scows, dig foundations, pull piles, lay concrete blocks, deposit back-filling, lift boulders, raise wrecks, dredge hard or soft material, and do nearly everything but vote. Its great simplicity made it light in repairs. With tools like these, and suitable for their work, the marvel is not that American contractors do not use the big and costly European ladder dredges, but that these useful American tools do not find a wider recognition in Europe and abroad.

## FARMERS BUILDING ELEVATORS.

In many parts of the agricultural west the farmers are organizing co-operative elevator companies to handle their own grain. The fruit growers of California have been disposing of their crops through their own companies for several years. The Grain Dealers Journal does not, however, look with favor on the co-operative elevator and says:

The history of the farmers' co-operative efforts in the grain line is one continuous record of failures, not always because they were unable to pay expenses, but generally because they did not reap the large profits promised, hence did not find sufficient grounds for continuing in the business. Many of these co-operative movements are the result of dissatisfaction on the part of the farmers who take the initiative to organize a company, but the majority are started by some schemer who wants to swindle the farmer. Without the supervision and constant push given it by the man who makes the grain business his business, the elevator must be operated at a loss instead of the much-talked-about gain. Few farmers' elevators have been operated to exceed ten years and the majority do not last four years.

By the Brussels conference France is prohibited from exporting any more beet sugar. Last year France produced more than 1,000,000 tons of the sugar and used but 450,000 tons.

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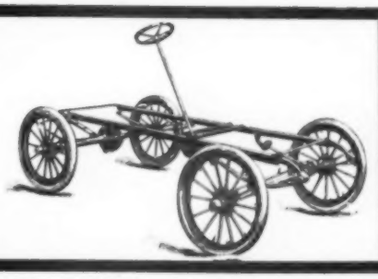

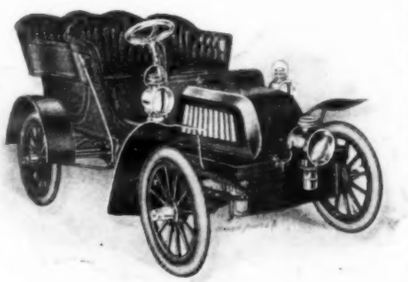

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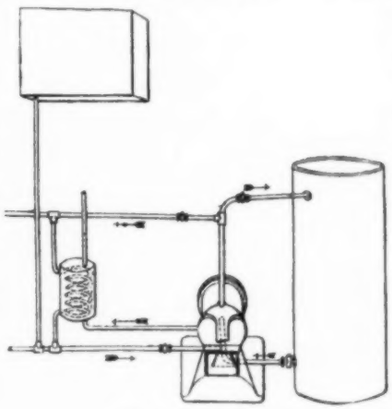
## HEAT FROM GAS ENGINES.

The problem of using the hot water generated by gas and gasoline engines for heating purposes, which has been the subject of much study on the part of American engineers, has apparently been solved by J. G. Grimsley of Leicester, England, who has been granted British letters patent on a system by which it is claimed this may be done.



Heat From Gas Engine

According to the claim of the inventor the method consists in connecting flow and return heating pipes respectively to the return and supply pipes connecting the water tank with the cylinder jacket. The drawing is from Engineering, London.

The exports of Germany have increased 30 per cent in the last ten years and those of the United States 29 per cent.

## THIN BRONZE DESIRABLE IN STATUARY.

Most people imagine the more metal there is in a bronze statue the better it is. As a matter of fact, the reverse is the case, and within the limits of strength and the possibility of securing a perfect casting, the thinner the metal the better by all manner of means, says the Monumental News. So far as local strength is concerned one-quarter inch of metal is amply thick enough for any statuary, but the intricacies of modeling and mold making suggest some leeway, and it may be asserted that not more than from one-quarter to one-half inch is required under any circumstances. A great thickness often makes the metal spongy and produces blow holes, the bane of statuary casting. In the process of cooling, as also afterward from changes in temperature, nature sets up strains of varying degrees of intensity and direction, so that it is a matter of economic endeavor on the part of the good founder to make his casting of as even a thickness as possible. Where other strains are created, due to the design or modeling, these are provided for by other means, independent of the shell thickness.

Another point that should be remembered is that increase of thickness of metal does not increase beauty or value. It is far more expensive, and requires more expert skill, to produce a thin casting than a thick one, and for which the extra metal does not compensate. The Chinese are wonderfully expert in casting bronze of remarkable thinness, producing artistic effects impossible with heavy flowing metal. Unnecessary thickness of metal tends to weakness rather than strength, and does not lend itself to the reproduction of the sculptor's spirit.

## AN EAGLE'S LIFTING POWER.

An eagle having a weight of sixteen pounds can carry away a lamb weighing sixty pounds. To do this it must develop about two-horse power and must put a strain of more than 1,100 pounds on the muscles of the wings. This lends one to think that "birds are stronger than mathematics."

When all the steamers are properly equipped with wireless telegraph, passengers can each day get the important news from both sides of the Atlantic.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